

06/15/99

JCS59 U.S. PTO

Please type a plus sign (+) inside this box → ☐Approved for use through 09/30/2000. OMB 0651-0032
Patent and Trademark Office U.S. DEPARTMENT OF COMMERCE

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

**UTILITY
PATENT APPLICATION
TRANSMITTAL**

(Only for new nonprovisional applications under 37 C.F.R. § 1.53(b))

Attorney Docket No. 11381

First Inventor or Application Identifier David W. Johnson

Title ELASTOMERIC ARTICLE WITH FINE COLLOIDAL

Express Mail Label No. EJ827490596US

APPLICATION ELEMENTS

See MPEP chapter 600 concerning utility patent application contents

1. ☐ * Fee Transmittal Form (e.g., PTO/SB/17)
(Submit an original and a duplicate for fee processing)
2. ☒ Specification [Total Pages 15]
(preferred arrangement set forth below)
- Descriptive title of the Invention
 - Cross References to Related Applications
 - Statement Regarding Fed sponsored R & D
 - Reference to Microfiche Appendix
 - Background of the Invention
 - Brief Summary of the Invention
 - Brief Description of the Drawings (if filed)
 - Detailed Description
 - Claim(s)
 - Abstract of the Disclosure
3. ☒ Drawing(s) (35 U.S.C. 113) [Total Sheets 3]
(Fig. 1-5)
4. Oath or Declaration [Total Pages 4]
- a. ☒ Newly executed (original or copy)
(not executed)
 - b. ☐ Copy from a prior application (37 C.F.R. § 1.63(d))
(for continuation/divisional with Box 16 completed)
 - i. ☐ DELETION OF INVENTOR(S)
Signed statement attached deleting
inventor(s) named in the prior application,
see 37 C.F.R. §§ 1.63(d)(2) and 1.33(b).

* NOTE FOR ITEMS 1 & 13: IN ORDER TO BE ENTITLED TO PAY SMALL ENTITY
FEES, A SMALL ENTITY STATEMENT IS REQUIRED (37 C.F.R. § 1.27), EXCEPT
IF ONE FILED IN A PRIOR APPLICATION IS RELIED UPON (37 C.F.R. § 1.28).

ADDRESS TO: Assistant Commissioner for Patents
Box Patent Application
Washington, DC 20231

5. ☐ Microfiche Computer Program (Appendix)
6. Nucleotide and/or Amino Acid Sequence Submission
(if applicable, all necessary)
- a. ☐ Computer Readable Copy
 - b. ☐ Paper Copy (identical to computer copy)
 - c. ☐ Statement verifying identity of above copies

ACCOMPANYING APPLICATION PARTS

7. ☐ Assignment Papers (cover sheet & document(s))
8. ☐ 37 C.F.R. § 3.73(b) Statement ☐ Power of Attorney
(when there is an assignee)
9. ☐ English Translation Document (if applicable)
10. ☐ Information Disclosure Statement (IDS)/PTO-1449 ☐ Copies of IDS Citations
11. ☐ Preliminary Amendment
12. ☒ Return Receipt Postcard (MPEP 503)
(Should be specifically itemized)
13. ☐ * Small Entity Statement(s) ☐ Statement filed in prior application,
(PTO/SB/09-12) Status still proper and desired
14. ☐ Certified Copy of Priority Document(s)
(if foreign priority is claimed)
15. ☒ Other: Certificate of Mailing by
Express Mail No. EJ827490596US
on June 15, 1999

16. If a CONTINUING APPLICATION, check appropriate box, and supply the requisite information below and in a preliminary amendment:

☐ Continuation ☐ Divisional ☐ Continuation-in-part (CIP) of prior application No. _____

Prior application information: Examiner _____ Group / Art Unit: _____

For CONTINUATION or DIVISIONAL APPS only: The entire disclosure of the prior application, from which an oath or declaration is supplied under Box 4b, is considered a part of the disclosure of the accompanying continuation or divisional application and is hereby incorporated by reference. The incorporation can only be relied upon when a portion has been inadvertently omitted from the submitted application parts.

17. CORRESPONDENCE ADDRESS

☐ Customer Number or Bar Code Label

(Insert Customer No. or Attach bar code label here)

or ☒ Correspondence address below

Name	Gregory Garmong				
Address	P.O. Box 12460				
City	Zephyr Cove	State	NV	Zip Code	89448
Country	United States	Telephone	775-588-0345	Fax	775-588-0346

Name (Print/Type)	Gregory Garmong	Registration No. (Attorney/Agent)	29,382
Signature	<i>Gregory Garmong</i>	Date	June 15, 1999

Burden Hour Statement: This form is estimated to take 0.2 hours to complete. Time will vary depending upon the needs of the individual case. Any comments on the amount of time you are required to complete this form should be sent to the Chief Information Officer, Patent and Trademark Office, Washington, DC 20231. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Assistant Commissioner for Patents, Box Patent Application, Washington, DC 20231.

APPLICATION OF

DAVID W. JOHNSON

for

UNITED STATES PATENT

on

ELASTOMERIC ARTICLE WITH FINE COLLOIDAL SILICA
SURFACE TREATMENT, AND ITS PREPARATION

Docket No. 11381

ELASTOMERIC ARTICLE WITH FINE COLLOIDAL SILICA SURFACE TREATMENT, AND ITS PREPARATION

This invention relates to elastomeric articles such as gloves, and their surface treatment to improve properties.

Elastomeric materials are used in many types of articles because of their rubbery properties. They elastically elongate up to hundreds of percent, and then return to or toward their original shape when released. Protective gloves used in medical procedures and manufacturing operations are examples of the application of elastomers. Elastomers may be either natural or synthetic.

Elastomeric articles are typically tacky to the touch when initially manufactured. The tackiness increases the difficulty in handling the glove during manufacture, packaging the glove for sale and shipment, and donning the glove by the user. Elastomeric gloves are usually processed to reduce their tackiness. Historically, the most common processing to reduce tackiness has been the application of a powder such as cornstarch to the surface of the glove during manufacture. The use of a powder is acceptable for many glove applications. A powder may not be used for other applications, such as for surgical gloves, because the powder may find its way into the surgical wound. A powder may not be used for some manufacturing operations where gloves are required, because the powder may fall into sensitive structures being fabricated. Powder-free processing techniques have been developed for such applications.

Another of the problems experienced with elastomeric gloves is that their outer surfaces may become slippery when they are wet, so that the user of the glove may find it more difficult to grasp objects in the gloved hand without losing the grip. This slipperiness problem is particularly troublesome for gloves treated by powder-free processing techniques, because the very processing which reduces tackiness on the inside surface of the glove, thereby aiding donnability, also tends to modify the outside

surface of the glove and reduce tackiness, thereby promoting loss of gripping power. Although efforts may be made to confine particular treatments to only the inside surface or the outside surface of the glove, these attempts have not been generally successful and have led to inconsistent results within lots of gloves.

The friction of the outside surface of the glove may instead be increased with a pattern of shallow ridges or the like on the outside surface. These features reduce the sensitivity of feel for the user of the glove, which is unacceptable for many applications such as medical and sensitive manufacturing operations.

There is a need for an approach to improving the friction of the outer surfaces of elastomeric gloves and the surfaces of other articles, which does not adversely affect other properties of the article and is consistent with powder-free manufacturing techniques. The present invention fulfills this need, and further provides related advantages.

SUMMARY OF THE INVENTION

This invention provides a surface-modified elastomeric article, such as a glove, and a method for its manufacture. The approach of the invention increases the surface friction of the outside surface of the glove. The approach is fully consistent with the use of powder-free manufacturing techniques and in those cases meets governmental requirements for powder-free articles. The improved outside-surface friction is achieved without modifying the basic physical structure of the article, without loss of the existing advantageous properties of the article, and with little increased cost. The treatment to achieve improved surface friction on some surfaces of the article may be applied in conjunction with other treatments of other surfaces of the article. For example, the outside surface of a glove may be treated to increase its friction, and the inside surface may be separately treated to improve its donnability without losing the increased friction on the outside surface. The mechanical properties of the basic glove are not sacrificed in order to attain improved donnability and grip retention. The surface modification of the article can also be made to increase the dissipation of static

electrical charge, reducing the incidence of damage due to such static electrical charges. The processing approach leads to excellent consistency in batches of manufactured gloves.

In accordance with the invention, a surface-modified article comprises an elastomeric matrix having a surface, and a plurality of colloidal silica particles adhered to at least a portion of the surface of the matrix but not extending through the thickness of the matrix. The colloidal silica particles are affixed to the surface of the matrix, preferably without any separate binder material affixing the colloidal silica particles to the surface. In a preferred application, the elastomeric matrix is in the shape of a glove that receives the human hand therein. The matrix has an inside surface that contacts the human hand received within the hollow elastomeric glove shape, and an oppositely disposed outside surface. The colloidal silica particles are affixed to the outside surface of the glove.

The elastomer may be any operable material, such as natural latex, or a synthetic elastomer, such as styrene butadiene, neoprene, isoprene, nitrile, styrene-ethylene-butylene-styrene (S-EB-S), styrene-isoprene-styrene (S-I-S), or styrene-polybutydiene-styrene (S-B-S) rubbers. The colloidal silica particles desirably have a size of from about 10 nanometers to about 100 nanometers.

In one embodiment, the colloidal silica particles are themselves provided or treated so as to have some electrical conductivity. The electrical conductivity may be produced by depositing a partially conductive layer onto the surfaces of the particles, such as a thin surface layer of aluminum chlorhydrate. The electrical conductivity of the partially conductive colloidal silica particles improves the electrostatic discharge (ESD) properties of the article, permitting static charge to dissipate more rapidly and completely than would otherwise be the case. Dissipation of static charge is an important requirement in many applications of elastomeric articles such as gloves, inasmuch as accumulated static charge in medical facilities or manufacturing plants may adversely affect treatments, instrumentation, and/or products.

The present invention also extends to a manufacturing method for preparing an article such as a glove. A method for making an elastomeric article comprises the steps

of preparing a coating composition comprising a plurality of colloidal silica particles, providing a mold whose surface defines at least a portion of the surface of the elastomeric article, and applying the coating composition to a surface of the mold to achieve a coated surface. The method further includes contacting a flowable elastomer to the coated surface of the mold, allowing the flowable elastomer to coalesce against the coated surface, and separating the formed elastomer from the mold surface.

In the preferred embodiment, the mold is a glove shape former. The coating composition includes a coagulant having the colloidal silica particles mixed therewith. The mixture of coagulant and colloidal silica particles is applied to the surface of the glove former, which is dipped into the flowable elastomer and withdrawn, and the coagulated elastomer forms the matrix of the glove. The glove matrix is turned inside out, with the result that the outside surface has the plurality of colloidal silica particles thereon. Before it is turned inside out, the exposed surface of the glove matrix, which later becomes the inside surface of the glove, may be treated to improve handling characteristics and donnability with either powder-based or powder-free methods.

The present invention thus provides articles and a method for producing articles that have a surface selectively covered with colloidal silica particles. Chemical or coating-type powder-free de-tackifying treatments to the inside surface of the glove, even where they also are applied to the outside surface, do not adversely affect the gripping enhancement of the silica particles on the outside surface of the glove. The gripping enhancement is based on the physical structure at the outside surface, not on chemical effects. The present approach therefore allows powder or powder-free treatments to be applied to the glove, enhancing manufacturability, shipping, and donnability, while simultaneously achieving excellent grip retention even when the glove is wet.

The particles are selectively present on the surface of the article to provide increased friction. In presently preferred applications, no other material in the form of a binder is used to bind the colloidal silica particles to the surface of the article. On the other hand, carefully chosen surface coatings may be used to achieve particular results. Examples are polyether or polyester polyurethanes and certain extensible acrylate-based

0334054-061509

copolymers. To enhance ESD properties other additives such as metal oxides, alkali metal salts such as lithium nitrate and polyethylene ether glycols may be employed. The colloidal silica particles are present only on the treated surfaces, and do not extend through the body or thickness of the matrix. If the colloidal silica particles were mixed through the entire thickness of the article, there would be a potential for adverse effects on the mechanical properties of the article due to the high volume fraction of particles present. The present approach selectively positions the particles on the surface of the article where they are required to increase friction and/or for electrical charge dissipation.

Other features and advantages of the present invention will be apparent from the following more detailed description of the preferred embodiment, taken in conjunction with the accompanying drawings, which illustrate, by way of example, the principles of the invention. The scope of the invention is not, however, limited to this preferred embodiment.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a perspective view of an article according to the invention, in this case a glove;

Figure 2 is a schematic enlarged sectional view through the matrix in the region of the palm of the glove of Figure 1, taken along lines 2-2;

Figure 3 is a schematic sectional view of a first embodiment of a silica particle;

Figure 4 is a schematic sectional view of a second embodiment of a silica particle; and

Figure 5 is a block flow diagram of a method for practicing the invention.

DETAILED DESCRIPTION OF THE INVENTION

Figure 1 illustrates an article according to the invention, in this case a preferred glove 20. The present invention is applicable to other articles as well, and is not limited

to the glove 20.

Figure 2 is a sectional view in the region of the palm of the glove 20, greatly enlarged to show the structures at the surfaces. The glove 20 is formed of an elastomer that is termed the "matrix" 22. The glove matrix 22 has an outside surface 24 and an inside surface 26. The inside surface 26 contacts the wearer's hand when the glove 20 is in use, and the outside surface 24 faces outwardly to contact gripped articles.

A plurality of particles 28 are adhered to at least a portion of the outside surface 24. The particles 28 are preferably colloidal silica (SiO_2) used in conjunction with the preferred manufacturing method to be described subsequently. Other types of particles, such as metal oxides (e.g., aluminum oxide) or combinations of colloidal silica and metal oxides may be used as well. Because colloidal silica particles are preferred, the remainder of the detailed description will be directed toward their use, with the understanding that other types of particles may be used.

Preferably, at least a palm 30 and gripping portions 32 of the fingers 34 of the outside surface 24 of the glove 20 have the colloidal silica particles 28 affixed thereto. Other portions of the glove 20, such as the portion overlying the back of the hand, need not have the colloidal silica particles adhered thereto, but no harm is done if the colloidal silica particles are present on these other portions as well. In a typical manufacturing operation, the colloidal silica particles will be adhered over the entire outside surface of the glove 20.

The inside surface 26 may be either exposed elastomer of the matrix 22, as in region 36, or it may be treated, as in region 38. Treatments to the inside surface 24 in the treated region 38 typically would be directed toward reducing the tackiness during manufacture and storage, and/or improving the donnability of the glove 20, because the inside surface 26 contacts the hand of the wearer when the glove 20 is used. A number of de-tackifying and donnability treatments are available, such as polymer coatings, powders, chlorination, and chemical treatments. Such donnability treatments are known in the art. A virtue of the use of colloidal silica particles 28 on the outside surface 24 is that it permits the use of no treatment on the inside surface 26, or any of a wide variety of treatments of the inside surface 26, without the loss of effectiveness of either

the colloidal silica particles 28 on the outside surface 24 or the selected treatment on the inside surface 26. The colloidal silica particles 28 are a physical element, not a surface treatment that may be eradicated or negated by the treatment of the inside surface 26.

Figure 3 illustrates one of the particles 28 in greater detail. The preferred particles are generally spherical, with a maximum dimension (diameter) preferably from about 10 nanometers to about 100 nanometers, although other sizes may be operable. The particles having a size range of from about 10 nanometers to about 100 nanometers have been employed most effectively in manufacturing prototype gloves. The particles 28 reside on the treated outside surface 24, and may be partially embedded into the outside surface 24 so that a portion protrudes above the outside surface 24. The colloidal silica particles 28 at the outside surface 24 of the glove 20 increase the friction between the outside surface 24 and an article being grasped by the hand of the wearer of the glove 20. The particles 28 are not easily removed by subsequent processing such as donnability treatments applied to the inside surface, nor are they readily removed by ordinary use of the glove. Consequently, the array of colloidal silica particles 28 provides a durable friction-enhancing physical feature on the outside surface 24.

The colloidal silica particles 28 do not extend throughout the entire thickness of the matrix 22. They are not incorporated throughout the matrix by mixing them into the flowable elastomer from which the matrix is made. This distinction is an important one, because a high fraction of colloidal silica particles distributed throughout the matrix, when they are needed only at the outside surface 24, may result in adverse effects on the physical properties of the glove, particularly its limit of extensibility in tension without failure. The colloidal silica particles 28 are present substantially only on the outside surface 24, not throughout the matrix. Occasional colloidal silica particles 28 may be present in the matrix as a result of the manufacturing operation, but they are not intentionally distributed throughout the matrix.

Figure 4 illustrates another type of colloidal silica particle 28. In this case, the particle 28 is made at least partially electrically conductive. In the pictured embodiment, the particles 28 have an electrically conductive surface treatment 44 applied thereto. An operable electrically conductive surface treatment 44 is the

application of a thin layer of a metal or a metal-containing substance such as aluminum chlorhydrate. Equivalently for the present purposes, the particles 28 could be made partially electrically conductive throughout, as by doping the silica that forms the particles 28 with a metal such as aluminum.

The use of electrically conductive particles 28 allows localized high levels of electrical charge, such as static charge or tribocharge, to be dissipated through conduction along particle-to-particle contacts. This electrostatic discharge (ESD) may be important in certain glove applications. For example, medical gloves may experience local charging for any of several reasons, and the local charging may adversely affect instruments or treatments. Gloves used in clean room facilities may also experience local charging, which may be transferred to the articles being manufactured or interfere with manufacturing operations, in either case adversely affecting the quality of the final product. The present approach provides for a reduction of locally high concentrations of static charge, eventually bleeding the charge to low, harmless levels. This reduction of static charge is accomplished without embedding wires in the glove matrix or other techniques that have been previously proposed but which interfere with the utilization of the glove in service or with its mechanical properties such as its extensibility. In a typical case, electrostatic decay times are reduced from 8-20 seconds to as low as 0.3 seconds with the approach of the invention, measured by the static decay test approach of Federal Test Method Standard 101C Method 4046. Specifications are listed in EIA-541, Mil B-81705C, and NFPA 99.

Figure 5 illustrates a preferred method for preparing an article, such as the glove 20, by the approach of the invention. A mold is provided, numeral 50. A surface of the mold defines at least a portion of the surface of the article to be manufactured, and in the preferred case defines the outside surface 24 of the glove 20. The mold for a glove is a shape of the human hand, known as a "former", made of glass, metal, porcelain, or other suitable material.

A coating composition is prepared, numeral 52. The coating composition includes the colloidal silica particles 28, mixed into a carrier which typically serves some other important function in the manufacture of the article. The colloidal silica

particles are obtained commercially. Both untreated and electrically conductive colloidal silica particles are obtained from a vendor such as DuPont as Ludox^R particles, or EKA Chemical as Bindzil^R particles.

In the preferred case, the carrier is a coagulant for the elastomeric composition that forms the matrix of the glove. (The carrier could be selected as a mold release agent in other applications.) A suitable coagulant is an aqueous solution of about 10-30 percent by weight calcium nitrate or calcium chloride, about 0.1-0.5 percent by weight nonionic, cationic, or amphoteric surfactant, and about 0.001-0.2 percent by weight silicone or non-silicone dewebbing agent. This coagulant is acidic with a pH of about 3.5-6.0, which requires the use of the acid-compatible colloidal silica rather than other forms of particles that are not acid compatible.

The colloidal silica particles 28 are mixed into the carrier in a suitable loading, which is typically from about 0.1 to about 10 percent weight/weight for gloves. If a lesser amount of particles are used, they are largely ineffective. If a larger amount of particles are used, the surface of the elastomer becomes excessively tacky. The high tackiness is a disadvantage for gloves, but could be desirable for other products. Preferably, the loading of colloidal silica in the coagulant carrier is from about 0.5 to about 3.0 percent weight/weight. The resulting coating composition has a specific gravity of from about 1.18 to about 1.20, and a consistency like that of water.

The coating composition is applied to the mold surface and allowed to dry in place, numeral 54. Coating is accomplished by dipping the former into the coagulant mixture and drying it in an oven.

A flowable elastomer is provided, numeral 56. This flowable elastomer forms the matrix of the glove after processing. The flowable elastomer is an elastomeric material in an appropriate solvent that allows it to flow. Suitable elastomers include any operable material, such as natural latex elastomer, or a synthetic elastomer, such as styrene butadiene, neoprene, isoprene, nitrile, styrene-ethylene-butylene-styrene (S-EB-S), styrene-isoprene-styrene (S-I-S), or styrene-polybutydiene-styrene (S-B-S) rubbers. This listing of suitable elastomers is exemplary, not exhaustive. Solvents for the various elastomers are known in the art.

The flowable elastomer is contacted to the mold which has been previously coated with the coating composition, numeral 58. In the case of the manufacture of a glove, the former is dipped into the flowable elastomer. Dip forming technology is well known in the art, and will be described only briefly. The coagulant in the coating composition causes some of the flowable elastomer to become locally unstable and coagulate onto the surface of the former. During this process, the elastomer coalesces, numeral 60, capturing the particles 28 present in the coating composition at the surface of the coagulating elastomer. The former is withdrawn from the mass of flowable elastomer, and the coagulated layer is allowed to coalesce fully. A coating or donning agent may be applied to the glove either before or after curing. Each dip typically applies from about 0.05 to about 0.20 millimeter of elastomer to the surface of the former, and the presently preferred approach utilizes a single dip. If a thicker layer of elastomer is required, the former is re-dipped to apply more elastomeric material. The elastomer is gelled with heat to strengthen the elastomeric film, leached with flowing hot water to remove impurities, and cured with heat to vulcanize, in the case of rubber, nitrile, and neoprene, and dry the film.

The now-solid layer of elastomer, forming the matrix 22, is separated from the mold, numeral 62. In the case of a glove, the elastomer is turned inside-out when it is taken from the former, so that the portion of the glove initially contacting the former becomes its outside surface 24 with the colloidal silica particles 28 thereon. In the separation step 62, the colloidal silica particles serve as a functional replacement for powder as a release agent.

The article is optionally post-processed, numeral 64. The post processing may include further drying, chlorination, or other donnability treatments, for example. Such treatments are known in the art. The order of the separating step 62 and the post-processing step 64 may be reversed or the steps may be intermixed, so that some or all of the post-processing operations may be conducted with the glove still on the former, while some or all of the post-processing operations may be conducted with the glove removed from the former. As noted earlier, the post-processing operations have little effect on the silica particles affixed to the surface of the article.

The present invention has been successfully used to prepare gloves according to the preferred procedure discussed in relation to Figure 5, using three matrix compositions: natural latex, and nitrile and styrene-butadiene synthetic rubbers.

A polymeric donnability-enhancing layer was applied to the inside surface of the natural latex gloves. These gloves were measured to determine their powder levels according to the procedures of ASTM D6124-97. Measured powder levels were about 0.2-0.3 milligrams of powder per glove, well below the maximum of 2 milligrams of powder per glove established by the Food and Drug Administration for powder-free articles. This result is significant, because substantially none of the silica particles were dislodged from the surface and measured as powder. Gloves made according to the present approach therefore qualify as powder-free gloves, if a powder-free donnability-enhancing treatment is applied to the inside surface of the glove. Protein levels in the absence of post processing were less than 50 parts per million. The coefficient of friction of the outside surface of the glove treated with the silica particles was increased by about 50-65 percent compared to gloves treated by other processes such as chlorination to render them powder free.

Although a particular embodiment of the invention has been described in detail for purposes of illustration, various modifications and enhancements may be made without departing from the spirit and scope of the invention. Accordingly, the invention is not to be limited except as by the appended claims.

0634054-06399

CLAIMS

What is claimed is:

1. A surface-modified glove article for use on a human hand, comprising:
an elastomeric matrix in the shape of a glove that receives the human hand therein, the matrix having an inside surface that contacts the human hand received within the hollow elastomeric glove shape, and an outside surface; and
a plurality of colloidal silica particles adhered to at least a portion of the outside surface of the matrix but not extending through the thickness of the matrix, the colloidal silica particles being affixed to the outside surface of the matrix.
2. The surface-modified article of claim 1, wherein the elastomer comprises natural latex.
3. The surface-modified article of claim 1, wherein the elastomer comprises a synthetic elastomer.
4. The surface-modified article of claim 1, wherein the elastomer comprises a nitrile rubber.
5. The surface-modified article of claim 1, wherein the colloidal silica particles have a maximum dimension of from about 10 nanometers to about 100 nanometers.
6. The surface-modified article of claim 1, wherein the colloidal silica particles are electrically conductive.
7. The surface-modified article of claim 1, wherein the colloidal silica particles further comprise

an electrically conductive surface treatment thereon.

8. The surface-modified article of claim 1, wherein the colloidal silica particles further comprise
a layer of an electrically conductive material on the surface thereof.

9. The surface-modified article of claim 1, wherein the colloidal silica particles further comprise
a layer of aluminum chlorhydrate on the surface thereon.

10. The surface-modified article of claim 1, further including
a inside surface treatment on the inside surface of the glove shape.

11. The surface-modified article of claim 1, wherein there is no separate binder material affixing the colloidal silica particles to the outside surface.

12. A surface-modified article, comprising:
an elastomeric matrix having a surface; and
a plurality of colloidal silica particles adhered to at least a portion of the surface of the matrix but not extending through the thickness of the matrix, the colloidal silica particles being affixed to the surface of the matrix without any separate binder material affixing the colloidal silica particles to the surface.

13. The surface-modified article of claim 12, wherein the colloidal silica particles are electrically conductive.

14. A method for making an elastomeric article, comprising the steps of:
providing a mold whose surface defines at least a portion of the surface of the elastomeric article;
preparing a coating composition comprising a plurality of colloidal silica

particles;

applying the coating composition to a surface of the mold;
contacting a flowable elastomer to the coated surface of the mold;
allowing the flowable elastomer to coalesce against the coated surface; and
separating the coalesced elastomer from the mold surface.

15. The method of claim 14, wherein the elastomeric article is a glove.

16. The method of claim 14, wherein the coating composition further comprises a coagulant.

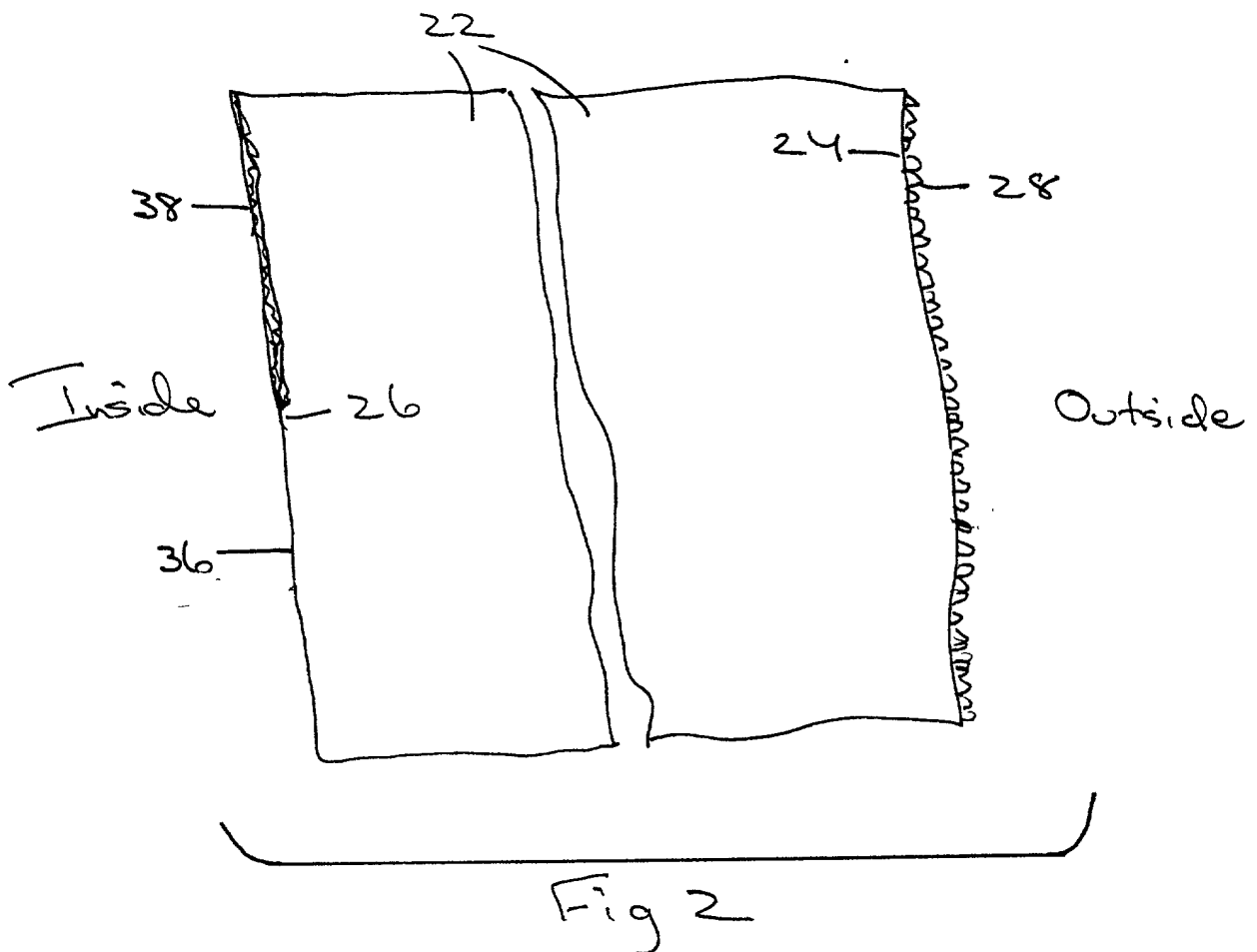
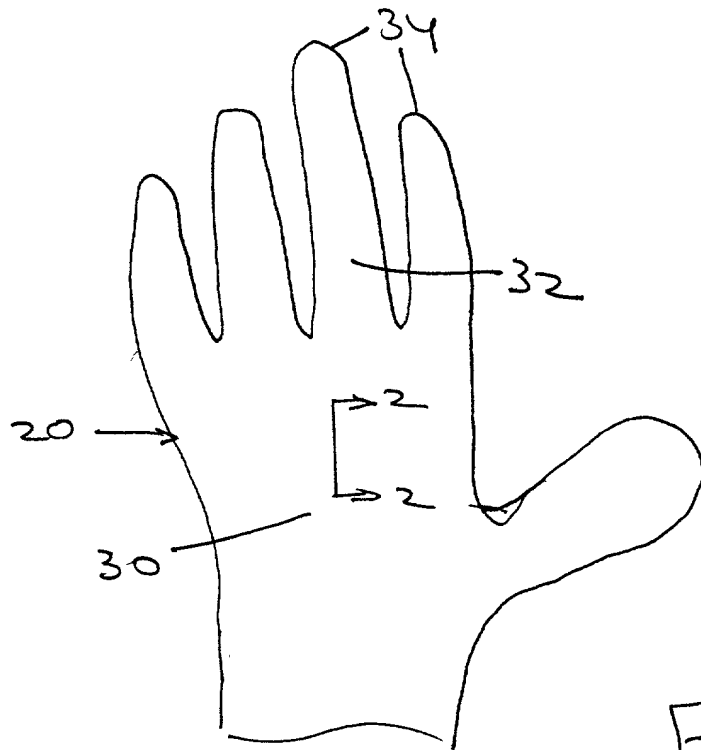
17. The method of claim 14, wherein the flowable elastomer comprises natural latex.

18. The method of claim 14, wherein the flowable elastomer comprises a synthetic elastomer.

19. The method of claim 14, wherein the flowable elastomer comprises a nitrile rubber.

ABSTRACT OF THE DISCLOSURE

A surface-modified article is formed of an elastomeric matrix, such as a glove shape, and a plurality of fine silica particles affixed to at least a portion of the surface of the matrix, the outside surface in the case of the glove. The fine silica particles increase the coefficient of friction of the article surface. The fine silica particles may also be made electrically conductive, so that static charge at the surface of the article is dissipated. The silica particles are applied by mixing them into a coating composition, applying the coating composition to the surface of a mold, and solidifying a flowable elastomeric composition against the coated surface. The coating composition may include a coagulant or a parting agent.



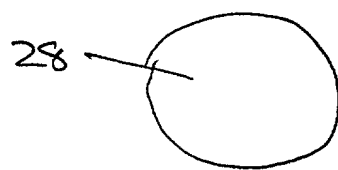


Fig 3

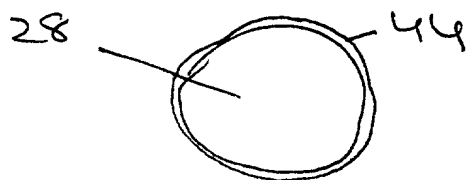


Fig 4

65790460650

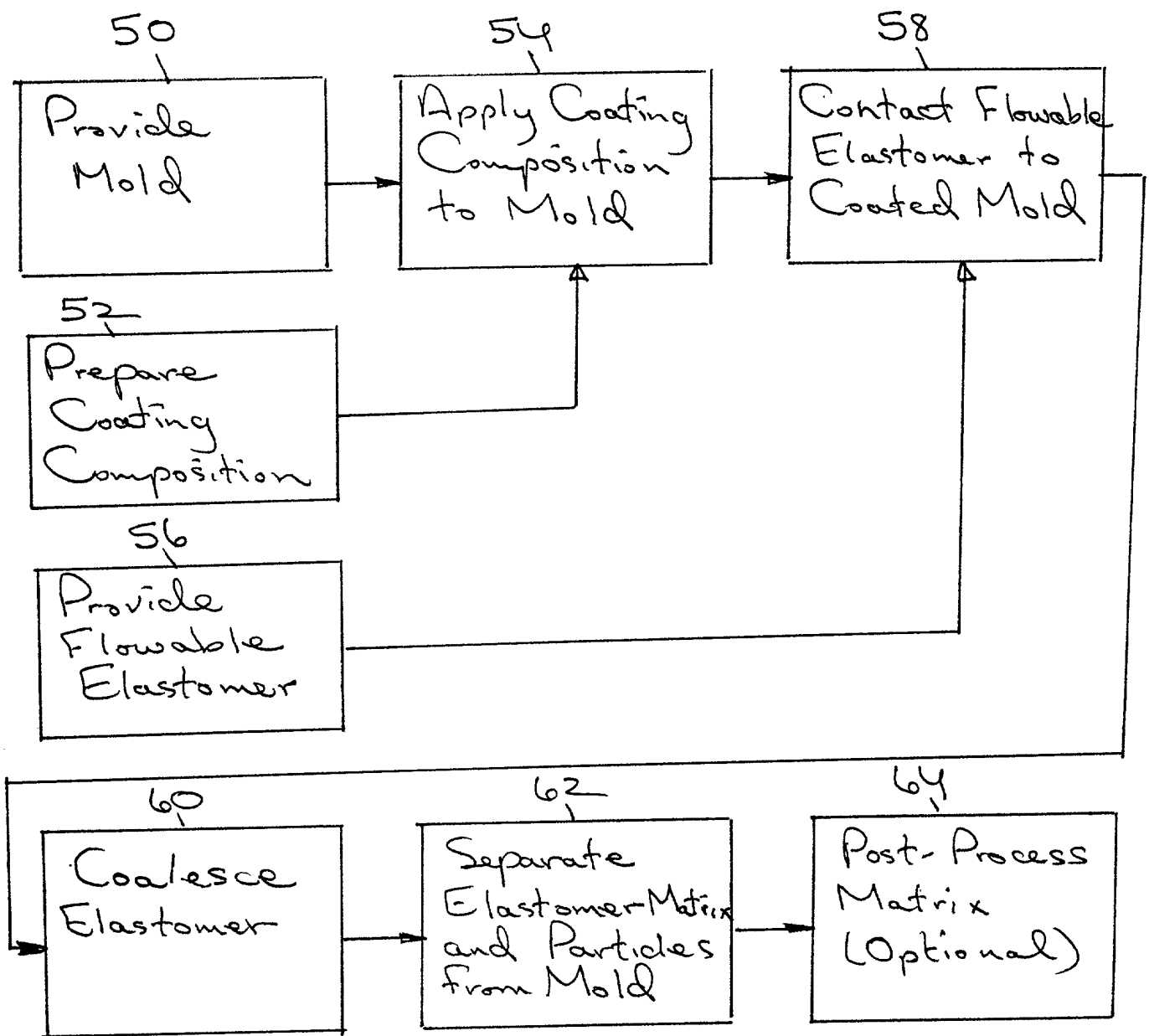


Fig 5

DECLARATION AND POWER OF ATTORNEY
FOR PATENT APPLICATION

As a below named inventor, I hereby declare that:

This declaration is of the following type:

- ☒ original
- ☐ design
- ☐ supplemental
- ☐ national stage of PCT
- ☐ divisional
- ☐ continuation
- ☐ continuation-in-part (CIP)

My residence, post office address and citizenship are as stated below next to my name,

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled ELASTOMERIC ARTICLE WITH FINE COLLOIDAL SILICA SURFACE TREATMENT, AND ITS PREPARATION, the specification of which (check one)

☒ is attached hereto
☐ was filed on _____
Application Serial No. _____
and was amended on (or amended through _____
(if applicable)
☐ was described and claimed in PCT international application No. _____
filed on _____ and as amended under PCT Article 19 on _____ (if any).

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment specifically referred to above.

I acknowledge the duty to disclose information which is material to patentability as defined in Title 37, Code of Federal Regulations, Sec. 1.56.

___ In compliance with this duty there is attached an information disclosure statement. 37 CFR 1.97.

___ In compliance with this duty there has been filed an information disclosure statement on _____. 37 CFR 1.97.

I hereby claim foreign priority benefits under Title 35, United States Code, Sec. 119, of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed:

X no such applications have been filed

___ such applications have been filed as follows:

Prior Foreign Application(s):

<u>Number</u>	<u>Country</u>	<u>day/month/year</u> <u>filed</u>	<u>Yes</u>	<u>No</u>
None				

I hereby claim the benefit under 35 USC 119(e) of any United States provisional application listed below.

Appln. Ser. No.

Filing Date

None

I hereby claim the benefit under Title 35, United States Code, Sec. 120 of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code, Sec. 112, I acknowledge the duty to disclose all information known to be material to patentability as defined in Title 37, Code of Federal Regulations, Sec. 1.56(a) which became available between the filing date of the prior application and the national or PCT International filing date of this application.

<u>Appln. Ser. No.</u>	<u>Filing Date</u>	<u>Status</u>
None		

Power of Attorney: As a named inventor, I hereby appoint the following attorney(s) and/or agents to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith: GREGORY O. GARMONG, Registration No. 29,382, and FELIX J. D'AMBROSIO, Registration No. 25,721.

Address all correspondence to:

Gregory O. Garmong
P.O. Box 12460
Zephyr Cove, NV 89448

Direct all telephone calls to GREGORY O. GARMONG at telephone No. (775) 588-0345. Direct any facsimile transmissions to GREGORY O. GARMONG at fax telephone No. (775) 588-0346.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States

///

///

///

///

///

///

///

///

///

///

///

///

Full name of sole or first inventor:

Inventor's signature: _____

Residence: 1366 Stoneridge Circle, Escondido, CA 92029

Citizenship: United States

Post Office Address: 1366 Stoneridge Circle, Escondido, CA 92029